CONCEPTUAL DESIGN OF LIQUID LITHIUM LABORATORY IN THE **TECHNOFUSIÓN** PROJECT

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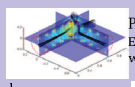
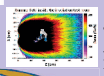


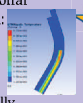
Plasma/wall Interacion Lab: Evaluation of plasma interactions with first wall materials.

Materials Irradiation Lab: Studies about radiation effects on structural and functional materials using simultaneous ions and electron accelerators.



Remote Handling Lab: Test of robotics and automation for remote handling under irradiation.

Computational Simulation: To study conditions cannot be reproduced experimentally.



Liquid Metal Lab: Development of liquid lithium technology.

Characterization Lab: Advanced characterization techniques for testing materials.

Materials Production and Processing Lab: Improvement of advance manufacturing technologies.

TechnoFusión:

The **TechnoFusión** project involves the construction of a relevant set of scientific-technical facilities in Madrid (Spain), providing new tools to fusion energy community. It will create an infrastructure to contribute to the development of nuclear fusion technology, assuring participation by Spanish research groups and engineering companies.

Thermonuclear fusion requires the development of several research projects related to the advances needed for the future fusion reactors. **TechnoFusión** focuses on technological issues as the radiation effects on structural and functional materials, evaluation of plasma interactions with first wall materials, development of advanced manufacturing technologies and corresponding materials characterization, improvement of liquid lithium technology, or computer simulation and robotics and automation for remote handling.

TechnoFusión Liquid Lithium Laboratory:

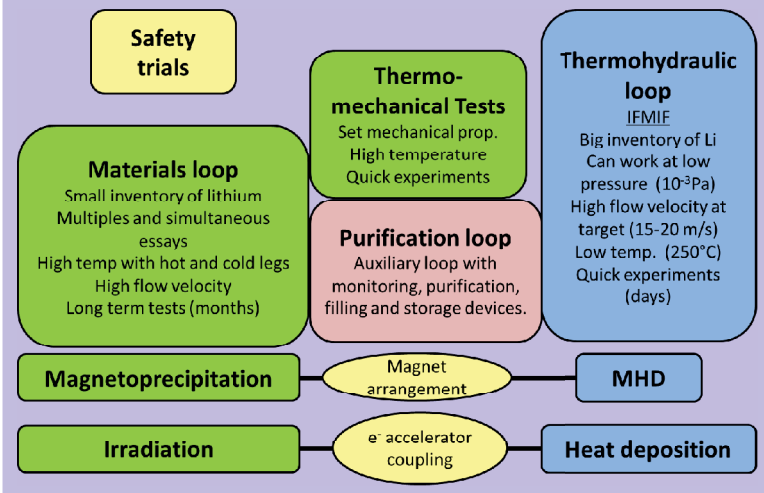
The improvement of liquid lithium technology is one of the milestones of the nuclear fusion pathway. Liquid lithium is a key component in some tritium breeding blankets and more recently, it is considered as a plasma-facing component. The development of this technology requires R&D to many phenomena: Interaction between liquid metal and structural materials as corrosion, erosion or embrittlement; chemical behavior of liquid lithium; coatings development; MHD; free surface fluid-dynamics; diagnosis and instrumentation of fluid lithium and any other physical or chemical aspect that will be important for their safe reliable operation. Nowadays, there is a significant shortage of experimental facilities committed to the development of the liquid lithium technology in Europe.

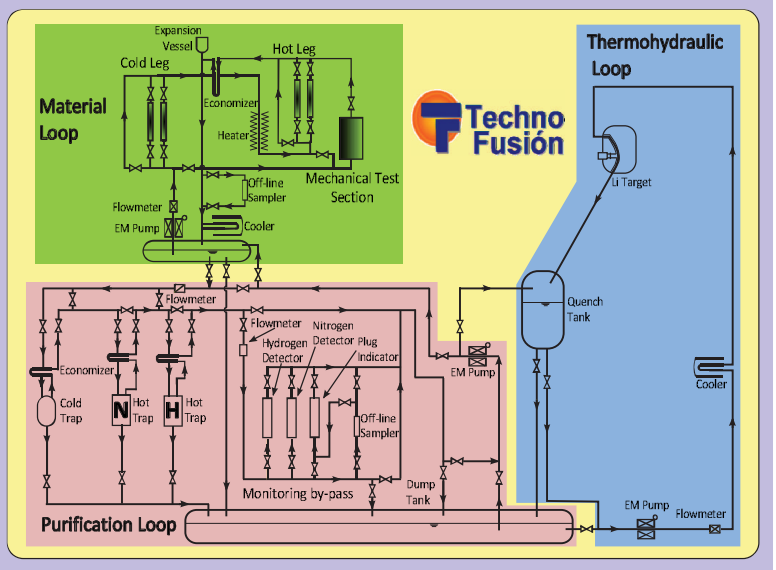
In the framework of the **TechnoFusión** project, an experimental laboratory of liquid lithium has been proposed, to back a technological transfer to regional and national industrial sector.

Objectives:

The **TechnoFusión Liquid Lithium Laboratory** has as main objetive provide useful scientific and technical information to the development of liquid lithium technology in several fields as:

- Analysis of liquid Li compatibility with fusion materials and coatings.
- Examine the mechanical properties of materials in contact with liquid lithium
- Understand the chemistry of lithium depending if its composition.
- Test of auxiliary systems as tritium extraction or liquid metal purification.
- Analysis of free-surface instabilities under vacuum and irradiation conditions.
- MHD experimentation and validation of computational design codes (CFD).
- Development of control and instrumentation devices for liquid Li loops.
- Production of critical safety information related to management of liquid Li.





Conclusions:

We have defined the objetives of this facility inside **TechnoFusión** project. Other facilities have helped us to rationalize a conceptual design of several liquid lithium loops and their coupling with the different proposed experiments.

This conceptual design is the starting point for a detailed engineering design. It should realize in close collaboration with Spanish engineering companies and regional and national goverment.

TechnoFusión Liquid Lithium Laboratory should devote itself to face future challenges in liquid lithium knowledge and encourage effective technology transfer from science to industry.

A. Abánades, A. García, N. Casal, J.M. Perlado, A. Ibarra, Fusion Eng. Des. 87 (2012) 161-166.

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